Dryland Vegetable Farming

Amy Garrett
OSU Extension Service
Small Farms Program
Introduction

• Cropping options on land without water?
• Climate change: reduced snowmelt, increased temperatures, and drought
• Vegetable growers using surface water for irrigation were cut off early during the 2015 growing season.
• 50% reduction in summer water availability in Oregon within 40 years (OCCRI)
Resources

- Steve Solomon
  - *Growing Vegetables West of the Cascades*
  - *Water-Wise Vegetables*
  - *Gardening Without Irrigation: or without much anyway*
- Carol Deppe
  - *The Resilient Gardener*
- David Granatstein
  - *Dryland Farming in the Pacific Northwest*
- California Ag Water Stewardship Initiative
- Widtsoe, John. 1920
What is dry farming?

- Crop production during a dry season like our summers here in the Willamette Valley.
- Utilizes the residual moisture in the soil from the rainy season instead of depending on irrigation.
The Dry Farming Project

- Work to date
  - Case studies
    - Western Oregon
    - Northern California
  - Demonstration
    - Field Day
    - Sensory Evaluation
    - Preliminary Yield Data
- Grant funding
  - Expand Demonstration
  - Participatory Dry Farming Research
Dry farming vegetables: One farmer’s approach to building soil, conserving water and producing great tasting tomatoes
Veneta farmer with 40 years experience

Small Farm News – Summer 2014 edition
Common misconceptions and key points about dry farming: Case study of dry farmer with more than 40 years of experience
Dry Bean Farmer in Elmira

- Grows dry beans for Hummingbird Wholesale
- Uses dry farming/irrigation as a tool to stagger his harvest
How Does Dry Farming Work?

- Starts with the soil!
  - Water-holding capacity
    - Clay
  - Organic matter - For each 1% increase in soil organic matter, soil water storage can increase by 16,000 gallons per acre-foot of applied water!
- 4’ of soil or more (Solomon)
- Nutrient-rich
- Site selection
  - Plants as indicators
  - Web Soil Survey
  - Soil auger

### 128B—Veneta loam, 0 to 7 percent slopes

#### Map Unit Setting
- **National map unit symbol:** 234m
- **Elevation:** 300 to 800 feet
- **Mean annual precipitation:** 40 to 60 inches
- **Mean annual air temperature:** 52 to 54 degrees F
- **Frost-free period:** 165 to 210 days
- **Farmland classification:** All areas are prime farmland

#### Typical profile
- H1 - 0 to 14 inches: loam
- H2 - 14 to 39 inches: clay loam
- H3 - 39 to 60 inches: clay

#### Properties and qualities
- **Slope:** 0 to 7 percent
- **Depth to restrictive feature:** More than 80 inches
- **Natural drainage class:** Moderately well drained
- **Capacity of the most limiting layer to transmit water (Ksat):** Moderately low to moderately high (0.06 to 0.20 in/hr)
- **Depth to water table:** About 36 to 72 inches
- **Frequency of flooding:** None
- **Frequency of ponding:** None
- **Available water storage in profile:** High (about 10.3 inches)
How Does Dry Farming Work?

- Crop/variety selection
- Soil preparation
  - Timing
- Planting technique
  - Plant when and where there is moisture
  - Increased plant spacing
  - Pre-soaking seed
  - Pressing soil around seed or transplant
    - Good seed soil contact
    - Creates capillary action wicking moisture to the surface to help seed germinate and get established
- Surface protection - dust mulch
Crop/Variety Selection

- Tomatoes
- Potatoes
- Watermelons
- Cantaloupes
- Winter squash
- Zucchini
- Dry Beans
- Corn
- Orchard crops
- Grapes
New Moon Organics - Shively, CA
New Moon Organics
“The biggest mistake I see Oregon farmers making when they attempt to dry farm is that they don't start working their ground at the right time. If they start when it's too wet, they'll never get the tilth right after that. If they work it too dry, they'll never get the moisture back unless they're saved by late rains, which we didn't get last year.” – Retired Dry Farmer
Dry Farming Demonstration
Oak Creek Center for Urban Horticulture
Dry Beans

June 15, 2015

July 27, 2015

September 10, 2015
Squash and Melons

June 15, 2015

July 27, 2015

September 10, 2015
Tomatoes and Potatoes

June 15, 2015

July 27, 2015

September 10, 2015
<table>
<thead>
<tr>
<th>Crop</th>
<th>Variety</th>
<th>Spacing</th>
<th>Planting Date</th>
<th>Harvest Date</th>
<th>Yield (lbs/plant)</th>
<th>Yield (tons/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato</td>
<td>Yukon Gold</td>
<td>2.5’ in row 5’ between row</td>
<td>May 5</td>
<td>August 10</td>
<td>4</td>
<td>7.0</td>
</tr>
<tr>
<td>Winter Squash</td>
<td>Zeppelin Delicata</td>
<td>4’ in row 5’ between row</td>
<td>May 27</td>
<td>September 25</td>
<td>8</td>
<td>8.6</td>
</tr>
<tr>
<td></td>
<td>Stella Blue</td>
<td>4’ in row 5’ between row</td>
<td>May 27</td>
<td>September 25</td>
<td>12</td>
<td>13.1</td>
</tr>
<tr>
<td></td>
<td>Blue Hokkaido</td>
<td>4’ in row 5’ between row</td>
<td>May 27</td>
<td>September 25</td>
<td>16</td>
<td>17.4</td>
</tr>
</tbody>
</table>

Average yield in irrigated systems
Organic potato yield (1’ in row, 3’ between row) = 10 – 15 T/A
Gray Kabochoha types of winter squash (1’ in row, 5’ between) = 15 – 24 T/A
# Dry Beans

<table>
<thead>
<tr>
<th>Dry Bean Variety</th>
<th>Low Density</th>
<th>Medium Density</th>
<th>High Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oland Swedish Brown</td>
<td>0.3</td>
<td>0.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Titus Cannellini</td>
<td>0.1</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Wolverine’s Orca</td>
<td>0.3</td>
<td>0.7</td>
<td>0.6</td>
</tr>
<tr>
<td>Whipple</td>
<td>0.7</td>
<td>1.1</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Yield for 25 row feet (lbs)
‘Dark Star’ Zucchini

Corvallis, OR

New Moon Organics - Shively, Ca

July 6, 2015

July 15, 2015

July 27, 2015

August 18, 2015

September 25, 2015
Dry Farming Field Day
More than 100 farmers and gardeners attended the field day.

- **Sensory Evaluation**: 27 of them participated in sensory evaluations and ranked the dry farmed watermelon and tomato higher than the irrigated in the categories of color, texture, and sweetness.

- **Follow-up survey**: 29 Dry Farming Field Day participants responded to a follow-up survey
Why is dry farming of interest to you?
- 11% - I don’t have water rights on my farm
- 11% - My well ran dry this year
- 86% - other reasons
  - Sustainability in a time of climate change
  - Conserving water, energy, and time
  - Weed management
  - Improved flavor

93% of them intend to apply what they learned at the field day on their land.
37% of responses were from farmers
Farming experience ranging from less than one year up to 40 years

7. What information about dry farming would be most helpful for you? Please check all that apply.

<table>
<thead>
<tr>
<th>#</th>
<th>Answer</th>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Understanding soil types compatible with dry farming</td>
<td>5</td>
<td>71%</td>
</tr>
<tr>
<td>2</td>
<td>Crops and varieties that work best for dry farming</td>
<td>7</td>
<td>100%</td>
</tr>
<tr>
<td>3</td>
<td>Plant spacing</td>
<td>7</td>
<td>100%</td>
</tr>
<tr>
<td>4</td>
<td>Timing of planting</td>
<td>6</td>
<td>86%</td>
</tr>
<tr>
<td>5</td>
<td>Soil and nutrient management</td>
<td>7</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>Understanding the economics of dry farming</td>
<td>1</td>
<td>14%</td>
</tr>
<tr>
<td>7</td>
<td>Other?</td>
<td>3</td>
<td>43%</td>
</tr>
</tbody>
</table>

Other?
- farming with minimal but maximizing forms of irrigation, mulching techniques
- All of the above, really, plus information on tillage and minimum tillage practices if applicable, best equipment, etc.
- I wonder if there are cover crops developed for dry farming
Beginners: Start small, experiment, and expand on your successes

2016 Dry Farming Demonstration at Oak Creek, NWREC, and SOREC

Growing Resilience: Water Management Workshop Series (Oregon SARE Mini-Grant)

Participatory Dry Farming Research in the Pacific Northwest
2016 Demonstrations

- **Crops/varieties**
  - **Potatoes:** Yellow Finn, Yukon Gold
  - **Tomatoes:** OP Early Girl, Big Beef
  - **Squash:** ‘Dark Star’ Zucchini, ‘Zeppelin’ Delicata
  - **Beans:** ‘Whipple’, Scarlet Emperor Runner Bean, OS Blues Bush Snap Bean
  - And more!

- **Spacing:** adjusted based upon what worked well in the 2015 Dry Farming Demo and interviews with farmers

- **Treatments:** Irrigated, Deficit Irrigated, Dry Farmed, Dry Farmed with Biochar Compost, Dry Farmed with Mulch

- **Data:** Yield, Sensory Evaluations, Soil Moisture, Track Inputs (labor, materials)

- **Dry Farming Field Days** in August 2016
For more information...

Visit:
http://smallfarms.oregonstate.edu/dry-farming-demonstration

Amy Garrett
Amy.garrett@oregonstate.edu
541-766-3551